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XIV. *Account of the Organs of Speech of the Orang Outang. By Peter Camper, M. D. late Professor of Anatomy, &c. in the University of Groningen, and F. R. S. in a Letter to Sir John Pringle, F. R. S.*

Q.

Read January 7, 1779.

S I R,

Klein-Lankum, near Franequer,
Dec. 2, 1778.

BEING lately informed by Dr. POEMMERING, whom on account of his singular industry and talents I have recommended to your favour, that you, as well as l'Abbé FONTANA and Dr. INGENHOUSZ, were surprized to hear from M. FEBRONI, the keeper of the Duke of Tuscany's Museum, that I had discovered the true organical reason for which the Orang Outang, and several other apes and monkies, are unable to speak; I take the liberty of addressing to you this anatomical essay upon the organ of speech of the Orang Outang and other monkies, in hopes you will judge it worthy to be read to the Royal Society; in whose most valuable Transactions I should be very proud to see these observations; the rather, as it is the first essay I have offered to that respectable body.

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It is this discovery (of which I have already given a hint at the end of my Observations on the Rein-Deer) which Professör ALLAMAND has inserted amongst his additions to the XVth volume of the Count DE BUFFON'S Nat. Hist. printed at Amsterdam 1771, for S. H. SCHNEIDER, p. 55, 56. Professör ALLAMAND has moreover added, in the same volume, p. 76: *M. le Prof. CAMPER a observé les organes de la voix de l'Orang; il s'est convaincu qu'il étoit impossible, qu'il formât des tons articulés, comme les hommes en peuvent former, &c.*

It is asserted by a great many travellers, that though the Orang Outang does not speak, he would be able to articulate if he chose it. Several Naturalists seem to leave this question undetermined, from not having had the opportunity of dissecting this very uncommon animal; others again overlook it, being deeply engaged in the researches of other parts.

My principal study in this essay will be to prove the absolute impossibility there is for the Orang and other monkeys to speak.

§ 1. Being Professör of Natural Philosophy, Anatomy, Surgery, and Physic, in the University of Franeker in Friesland, I soon perceived the impossibility of understanding the most precious and valuable works of the immortal GALEN (especially his anatomical works)

without

without dissecting monkies, to compare his exact descriptions with. I got for that purpose, in the year 1754, a *Cynocephalus*, and was charmed to find the exactness of almost all GALEN's descriptions. The organ of speech puzzled me, nevertheless, very much, and I was not able to explain his observations, so as to satisfy myself in this animal: I was obliged, therefore, for want of other apes, to delay my researches to another opportunity, which, however, I did not meet with till I came to Amsterdam, where I settled in the year 1755.

I discovered, at the beginning of 1757, in another *Cynocephalus*, that the basis of the *os hyoides* was very large and hollow; and that a membranous bag, lying under the *latissimi colli* (which touch one another in the middle of the neck in these animals) went up into this bony cavity, having a communication with the inside of the *larynx* by a hole at the root of the *epiglottis*.

The structure of these and the Orang will be better understood by the four figures engraved after my own drawings for the anatomy of the Orang. I intend to publish them with that of the Rhinoceros with the double horn, and the Rein-Deer.

In the *Cynocephalus* I found the whole organ of voice pretty much like that of dogs, except the pouch *d, n, o, i,* fig. 4. Examining the root of the *epiglottis* I found a
hole

hole *i*, *p*, fig. 3. being the real orifice of the bag *d*, *i*, *o*, *n*, fig. 4.

As all this lies above the *rima glottidis i*, fig. 3. or *i*, *b*, fig. 4. I concluded, that the voice, having passed the *glottis*, entered this membranous bag, *d*, *n*, *o*, *i*, by which the neck swelled, and out of which the air was forced by the contraction of the *latissimi colli*. I had often observed this swelling in some living apes, but now found out the reason of it, and was persuaded of the incapacity of this animal to modulate his voice so as to articulate words.

I then considered this remarkable passage of GALEN's, de Ufu Part. Ed. Charter. tom. IV. lib. 7. cap. XI. p. 461. *Foramen in utraque lingula (epiglottidis) parte unum effecit natura, et foramini ipsi parte internâ ventriculûm supposuit non parvum. In quem quum aer vias nactus amplas in animal ingreditur, rursusque exit, nihil in ventrem depellitur; and what he, p. 466. further observes, fissuram potius, quam foramen esse.*

When I compared this with the organ in the Cynocephali, fig. 3, 4. I was at a loss how to explain GALEN; for I could by no means apply those *ventriculi*, by which he seemed to have understood large capacities, to the small holes *b*, *i*, *k*, fig. 4. above the *rima glottidis i*, *b*, which, though much larger in the Cynocephali than in

men, could not be applied to this very particular definition of no small bags, *ventriculum non parvum*,

In November 1758 I dissected another monkey, in which the membranous bag, *d, n, o*, was much larger, so as to occupy almost the whole fore part of the neck, under the *latissimi colli*.

In the *Apella* (the 29th species of LINNÆUS, Syst. Nat. ed. XII. p. 42. or *simia caudata imberbis, cauda subprehensili, corpore fusco, pedibus nigris*) was no such a bag at all, nor any opening at the root of the *epiglottis*, which was entirely similar to that of dogs. I cannot forbear to mention, that in this monkey the *meatus*, or the *processus peritonæi*, were closed as in men. This I dissected in the year 1768, when I was Professor in the University of Groningen.

Here I got the opportunity, the year following, of dissecting two *papiones* or *spbinges* of LINNÆUS, *simia semi caudata ore vibrissato unguibus acuminatis*, spec. 6. p. 35. a male and a female; in which the *epiglottis* was likewise perforated, the *os hyoides* as in the former, but the pouch very small in comparison of the apes, who were very large.

As these parts are so apparent in a great many monkeys, and likewise in the ape or *Pitbecos*, I was very much surprized EUSTACHIUS did not discover them, especially:

as

as he had taken great pains to pursue the anatomical doctrine of GALEN, as appears in the XLIII plate, where he has given several figures of this organ. I was no less surprized that ALBINUS and MARTINS did not find this bag; and I wondered likewise very much, how Mr. D'AUBENTON, who has had the greatest opportunity of any anatomist, could pass over so striking a construction of this organ. I do not mention RIOLANUS, FALLOPIUS, GORTER, SYLVIVS, BLASIVS, and some others, because they had fixed their attention upon quite different parts.

§. 2. As GALEN not only dissected the *Cebi*, or the *Cynocephalus*, who are all of the tailed or *caudati* kind, but the *Pithecus* or ape without a tail; and as the celebrated Dr. TYSON had found the organ of voice so similar to that of men in his *Pigmy*, I endeavoured to get one from the East Indies. For this purpose I offered a good sum of money to my correspondents to have a well-preserved Orang Outang, because none were to be met with in any collection of Natural History in Holland.

I soon got a female one in the year 1770, by the kindness and generosity of Dr. HOFFMAN, physician at Batavia, formerly my pupil; and the year 1771 another, by favour of Mr. HOPE, Director of the East India Company of Amsterdam, and Representative of his Most Serene Highness the Prince of Orange in the same Company,

who was so good as to order not only a female, but a male one for my use; but this last was unluckily lost, with the whole ship, betwixt Java and the Cape of Good Hope.

These and the succeeding years were very favourable to Naturalists; for Professor ALLAMAND got a male Orang for the Museum of the University of Leyden; Mr. VANDER MEULEN, a great admirer of natural history (who has one of the finest collections at Amsterdam) received one, and Mr. VOSMAER got two for the celebrated collection of the Prince of Orange, all females. In the year 1777, Dr. VAN HOEY (a physician of great celebrity at the Hague, who has a very rich collection of natural curiosities) got a male (but a very young) Orang. Upon the whole, I had an opportunity of seeing seven Orangs, besides the living one, which was sent to his Highness the Prince of Orange.

All these resembled perfectly in shape and colour that of Mr. EDWARDS, which is still preserved in the British Museum.

Seven of those, I had seen, had no nails upon the great toes of the feet: it surprized me, therefore, to see them so distinctly represented by Professor ALLAMAND. I took the liberty to inform him of it; he corrected his description accordingly, p. 75. *ib. in fine*, which was easily

done, as the ſheets were not worked off at the preſs. I wrote likewiſe to Dr. KOOYſTRA, phyſician to the London Infirmary, to inquire about the Orang in the Britiſh Muſeum. The late Dr. MATY examined, at my requeſt, the Orang with him; and both declared, that not a ſingle mark of a nail was to be found upon the large toes of that ſpecimen, though Mr. EDWARDS had repreſented them on his 213th table ſo very large. Theſe two inſtances ſhew us, how little we can depend upon figures, if not drawn with great exactneſs.

The want of theſe nails, and of the ſecond phalanx of the large toes, is beyond any doubt a very remarkable character in this animal. Nature, however, ſeems to be inconstant ſometimes; for, upon the great toe of the right foot of the Orang in Dr. VAN HOEY's collection, there was a little nail and two phalanges. The ſingular red, long hair, and the ſhortneſs of the neck, form another very peculiar property; for in the living, as well as in all the reſt, I have obſerved the ſhoulders to riſe up to the ears; the lower and upper jaws were much projected forwards, as I ſhall ſhew in the anatomical deſcription of the Orang. The country they all came from was Borneo, from which iſland they are firſt ſent over to Java, and ſo to Holland by the Cape of Good Hope.

The

The Orang Outangs described by TULPIUS and TYSON came from Angola, and had both black hair, and large nails upon the great toes. I own the figures of these great men are very deficient in many respects: but, upon the whole, the animals are represented and described as very strong and muscular; whereas all the Orangs from Borneo, I have seen, were the contrary, and had long and very lean arms and legs.

To conclude, it seems very probable, that Africa furnishes a peculiar sort of apes which are not the *Pithecos* of the ancients, though these are not uncommon in Angola.

The organs of voice of the Angolese Orang, dissected by TYSON, are very different from those of the *Pithecos* which I dissected 1777. This one had the *os hyoides* like all the *papiones* or *spingies*, &c.; the *epiglottis* perforated as in fig. 3. and 4. and therefore different from GALEN's description, and from TYSON's, who makes no mention at all of the one, nor of the two bags which GALEN describes, and which I found in the real Orang of Borneo; not only in one specimen, but in five, which I have dissected for that purpose.

To return to GALEN; I am very apt to think that he dissected an Asiatic Orang, from whom he took his description of the ventricles *a latere lingula*, at the sides of the *epiglottis*; at least that he dissected such an organ, for

the bones of the *carpus* do not entirely agree with his description, though he seems to have been very exact and nice in his dissections. And indeed I wondered as often as I compared the structure of the *carpus* and *tar-sus* of apes, monkeys, and dogs, with GALEN's *osteological* performances upon this subject: for though he describes but eight bones in the *carpus*, he mentions the ninth, which I have met with in all monkeys, apes, and dogs, and likewise in the Orang. The tenth is not easily seen, it being very much attached to the *os naviculare*. These bones I shall give the explanation of in the anatomical description of the Orang.

In the Angolese Orang, Dr. TYSON met with the vermicular process of the *intest. cæcum*, which I found very considerable in the Asiatic; but of which GALEN appears not to have had the least notion. Mr. D'AUBENTON has given the description and figure of the same little gut in the Gibbon, a species approaching to that of the Orang; and likewise an inhabitant of Asia, but also unknown to GALEN.

§ 3. I shall now proceed to the organ of speech itself, and describe it as it appeared in the first Orang I dissected in October 1770. And for the clearer understanding I shall add some figures to it; first, of the fore-part; secondly,

secondly, of the *larynx* from the inside of the *pharynx*; and, lastly, of the inside of the *larynx* itself.

Fig. 2. N, O, P, represents the *os hyoides*; N, O, the basis; P the left *cornu*; N, O, the little graniform bones.

Q, T, U, the *thyroid* cartilage; V the *aspera arteria*.

Z, X the right ventricle cut open; R, S the left.

Y the hole leading into the bag. The ventricles form here a kind *meatus*, passing over the brim of the *thyroid* cartilage, under the *os hyoides*, towards the inside, where they form the fissures *a*, *b*, and *a*, *i*, fig. 5. I dissected this in the Anatomical Theatre of the University at Groningen in public.

In a second, which Mr. VOSMAER, the keeper of the Prince of Orange's cabinet, was so kind as to grant me for dissection, I found both these ventricles the same in every respect as the others, except that these last were of equal size.

In the third, which I dissected at the house of Dr. VAN HOEY at the Hague, the 31st of August, 1777, the two ventricles were smaller but of equal size on both sides. The animal was very young. The doctor preserves this preparation in his museum.

In a fourth, which I preserve entire in my collection, but whose organ of voice I examined the 30th of November

venner laſt, I found both the ventricles united ſo as to form but one.

The 6th figure gives a ſketch of it; *a, c, d, e, f, g, b*, *b*, is the ventricle, having, nevertheleſs, the two *meatus's* *a* and *b*, and ſhewing evidently a kind of diviſion in *i*; *g, b*, making a ſmaller bag.

This bag deſcended downwards to the middle of the breaſt bone, and ſpread itſelf ſidewards over the *ſternomaſtoideus*, with appendices underneath the *cucullares*.

The *latiſſimi colli* adhered very much to the fore-part, but ſidewards; and under, from the muſcles of the neck, they were eaſily ſeparated by tearing gently, either with the top of the finger, or with the flat part of the handle of a diſſecting knife.

As this Orang was much larger than the former ones, and conſequently older, I dare not venture to determine, whether theſe ventricles or bags, which touch each other in the middle, grow together, ſo as to make but one bladder; or whether this may be a variety: becauſe in the Orang which was alive at the Hague, and the hiſtory of which I ſhall give by and by, there was likewise but one bag ſtill larger than theſe, and proceeding far over the *clavicles*, backwards under the *cucullares*, and before down two-thirds of the breaſt bone.

This accidental union can probably make no essential variety; for as these receptacles of air do not seem to serve for any modulation of voice, they will answer their proper purpose, whether united into one, or divided into two cavities. We very often see the kidneys united at the lower ends across the spine in men, without its occasioning any disturbance in the secretion or animal economy.

§ 4. I must now give the history of the so much celebrated Orang which belonged to the Prince of Orange, and died in January 1777. This was a female; when alive the head was always deep in the shoulders, and the animal seldom lifted it very high up. The man who took care of her observed a great quantity of air under the skin of the neck on both sides, which (being ignorant of these ventricles) he took for a dangerous disorder, and the symptoms of approaching death. I felt the neck myself in December 1776, and discovered the bags to be much larger than any I had dissected. I could remove the air easily with my hand from one side to the other, and divide it, as it were, into two parts. The bags appeared sometimes very turgid, sometimes collapsed.

She died not long afterwards, and was soon cut to pieces by the order of Mr. VOSMAER, to be stuffed for the Museum of his Serene Highness the Prince of Orange; but, as this cannot be done without preserving the face, a part of the skull, hands, and feet, it is very evident, that Mr. VOSMAER

was

was obliged to cut off the head and the other extremities, and to destroy the most interesting parts for natural knowledge.

I was very sorry to hear the fate of this curious and uncommon creature, more especially as I had great reason to flatter myself with the dissection of the entire animal as soon as it was dead.

I need not remind any one of the particulars mentioned by Mr. FORSTER in the 2d volume of a Voyage round the World, p. 553.; nor of his rather too severe criticism upon the conduct of Mr. VOSMAER, the inspector of the Museum belonging to the hereditary Stadholder of the United Provinces. Mr. VOSMAER had, without doubt, no other intention but to preserve the fresh skin of this uncommon animal stuffed, for the cabinet of his benefactor, and not the least malevolent intention to prevent the dissection of the other parts not necessary for this purpose: for, when, by a special order of his Most Serene Highness the Prince of Orange, the remaining trunk was sent to me, I found the organ of voice not in the least hurt, and quite entire, as it is still to my great satisfaction. After having duly examined, dissected, and delineated the *viscera* of the breast and belly, I have put it in melasses, in a fine phial, in order to preserve so valuable a preparation, not only for my museum, but for natural knowledge in general.

There

There was no difference betwixt this organ and that ^I delineated in the 6th figure, but in extent. The united ventricles covered the greatest part of the breast bone, and had several appendices, which insinuated themselves into all the interstices of the muscles of the neck and shoulders.

It had likewise two distinct *meatus's* coming from the inside of the organ at the sides of the *epiglottis*, as in fig. 5. and passing between the *os hyoides* and *thyroid* cartilage.

A large and vermicular process was attached to the *cæcum*; but the intestines were very different on the inside from those of men. The *os femoris* was kept in its socket only by a strong capsular ligament, there being no *ligamentum teres*. I had not observed one in the Orang which I preserve, and whose feet I dissected, to compare them with GALEN and others.

§ 5. Having given the structure of the organ of voice in five different Orangs, and demonstrated their conformity in every other respect but the union I mentioned in some, I shall proceed now to the internal part of the organ, as it is described by GALEN.

Fig. 5. shews the inside of the organ, which is represented in fig. 2. consequently of the same Orang.

d, e, f, is the *epiglottis* or *lingula*.

g, b, k, l, the *cricoid* cartilage, divided in the middle, and expanded sidewards.

b, d, b, and *g, i, f*, the *arytenoid* cartilages.

i, a, and *a, b*, the holes or fissures at each side of the *epiglottis*; *b* and *i*, the cords which form the *rima glottidis*. All this answers exactly to the description given by GALEN.

The air which is forced by expiration out of the lungs, and passes with an accelerated velocity the *rima glottidis*, *b, i*, being stopped by the hollow *epiglottis* and the roof of the mouth, narrow nostrils, &c. rushes into these ventricles *z, x* and *q, r, s* fig. 2. or into the united large ventricle *a, b, d, e, f, g*, fig. 6. These are, as GALEN rightly observes, seemingly within the animal; for they are covered with the external integuments and the *latissimi colli*. From thence, or out of these ventricles, the air gets out again by the same fissures *a, i, a, b*, fig. 5. through the mouth and nostrils, without entering into the lungs again, or, as he expresses it, without entering into the belly of the animal, *rursusque exit, nihil in ventrem depellitur*; by *venter* is to be understood the inside of the body.

If this organ does not answer entirely to the description of GALEN, I do not know how to explain the quotation; for there is no animal, as yet known, whose organ
of

of speech is more applicable to it, at least none of the monkey kind, as I observed before.

It is hardly to be conceived, how Dr. TYSON should have overlooked all this, and have pronounced the organ of voice of his pigmy to be exactly like that of men, as he has done p. 51.; and yet, it is not impossible, when we consider that he has overlooked other and more striking differences in his essay.

Nor is it probable that GALEN should have overlooked the large vermicular process of the *cæcum* and other things, if he had dissected the same kind of African Orang as TYSON did, unless he dissected the Organ of voice in the one, neglecting the intestines, and again the bones of the feet in another, as is often the case with anatomists, as I know by my own experience. This, however, seems probable, that GALEN dissected more than one species of *pithecos* or apes without a tail, and that even that species was different from the Angolese pigmy and from the Orang of Borneo.

§ 6. Having dissected the whole organ of voice in the Orang, in apes, and several monkeys, I have a right to conclude, that Orangs and apes are not made to modulate the voice like men: for the air passing by the *rima glottidis* is immediately lost in the ventricles or ventricle of the neck, as in apes and monkeys, and must conse-

quently return from thence without any force and melody within the throat and mouth of these creatures: and this seems to me the most evident proof of the incapacity of Orangs, apes, and monkeys, to utter any modulated voice, as indeed they never have been observed to do.

I have already mentioned in the anatomical description of the Rein Deer (p. 55. of Mr. ALLAMAND's addition to the XVth volume of the Count DE BUFFON) the surprising analogy of its organ of voice with that of the *Pitbeci* and *Cercopitbeci*. That of the Orang seems to have some analogy with that of frogs, whose voice, however, can be better modulated by their tongues. I have given a description of them in the Memoirs of the Society of Rotterdam. As I am afraid of having dwelt already too long on this subject, I shall here finish this essay; but promise to send the Society an account of the very extraordinary organ of voice of the *alouate* or *bux-leur de Cayenne*, the *Simia Capucina* of LINNÆUS, n. 30. p. 42. the organ and *os hyoides* of which, &c. I dissected some time ago with all possible care and attention.

I am, &c.

EXPLANATION OF THE FIGURES.

Fig. 1. represents the *pharynx* of the Orang Outang, from which the organs of voice, fig. 2. and 5. are delineated.

A, D, B, C, the tongue from behind. .

D, B, C, M, the *palatum molle*, on the back part of which the *uvula* B, L is seen.

B, E, G, H, F, the *pharynx*, divided lengthways in the middle from E to G.

K, M, J, the passage from the mouth into the *œsophagus* S, K, G, H. Within this is seen the *epiglottis* and the *glottis* shut by the *arytenoid* cartilages.

Fig. 2. is the same organ of voice from the fore-part N, O, P, the *os hyoides*; N and O the little graniform bones; P, the left *cornu*.

Q, T, U, the *thyroid* cartilage; V the *aspera arteria*.

R, S, the left ventricle intire.

W the right, cut open to see the orifice of the duct r from the bag.

Fig. 3 The back part of the tongue and the *glottis* of a monkey.

a, b,

a, b, the *epiglottis*; *a, b, r, g*, the root and back part of the tongue; *c, s, t, d*, the *œsophagus* laid open.

u, the *aspera arteria*.

f, e, the *capitella* of the *arytenoid* cartilages.

e, the upper part or top of the little cartilage between the *arytenoid* cartilage and the *epiglottis*, which I have likewise met with in men, but less prominent.

i, f, the *rima glottidis*.

p, i, the hole at the root of the *epiglottis*.

Fig. 4. the inside of the *larynx* in profil.

a, b, c, d, the *epiglottis*; *e*, the cartilage mentioned in fig. 3.

f, b, the *arytenoid* cartilage; *f, g*, the *capitellums* forming a kind of crooked hook.

i, m, the cord of the *glottis*.

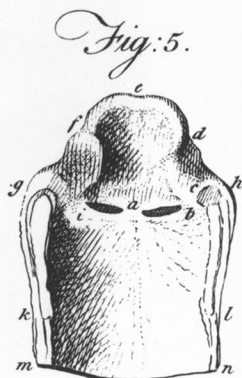
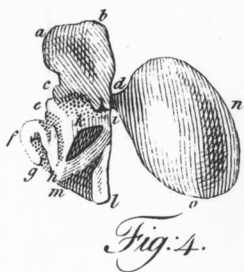
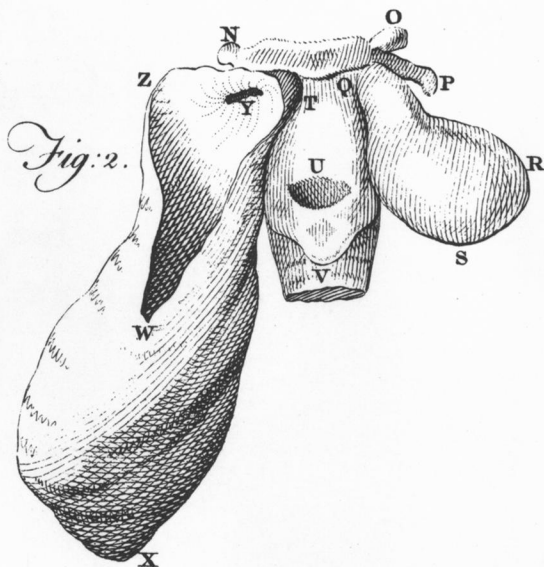
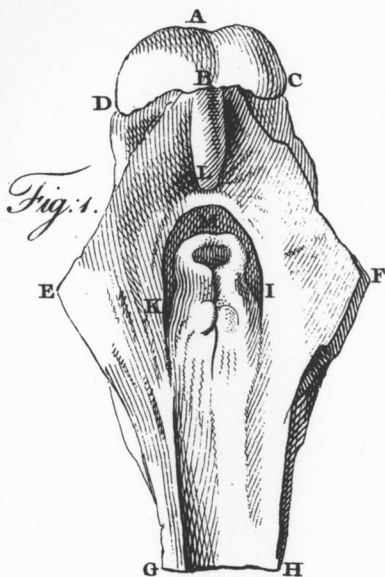
i, k, b, the lateral *sinus* above the *rima glottidis*, forming a pretty large ventricle in these animals.

i, m, l, the *cricoid* cartilage.

d, n, o, the ventricle, into which the air, coming through the hole at the root of the *epiglottis*, enters.

Fig. 5. the same *larynx*, represented in fig. 1. opened, to see the inward parts.

a, the union of the cords forming the *rima glottidis*.



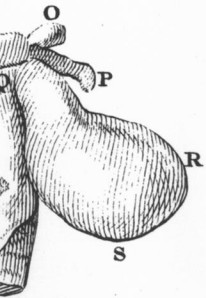
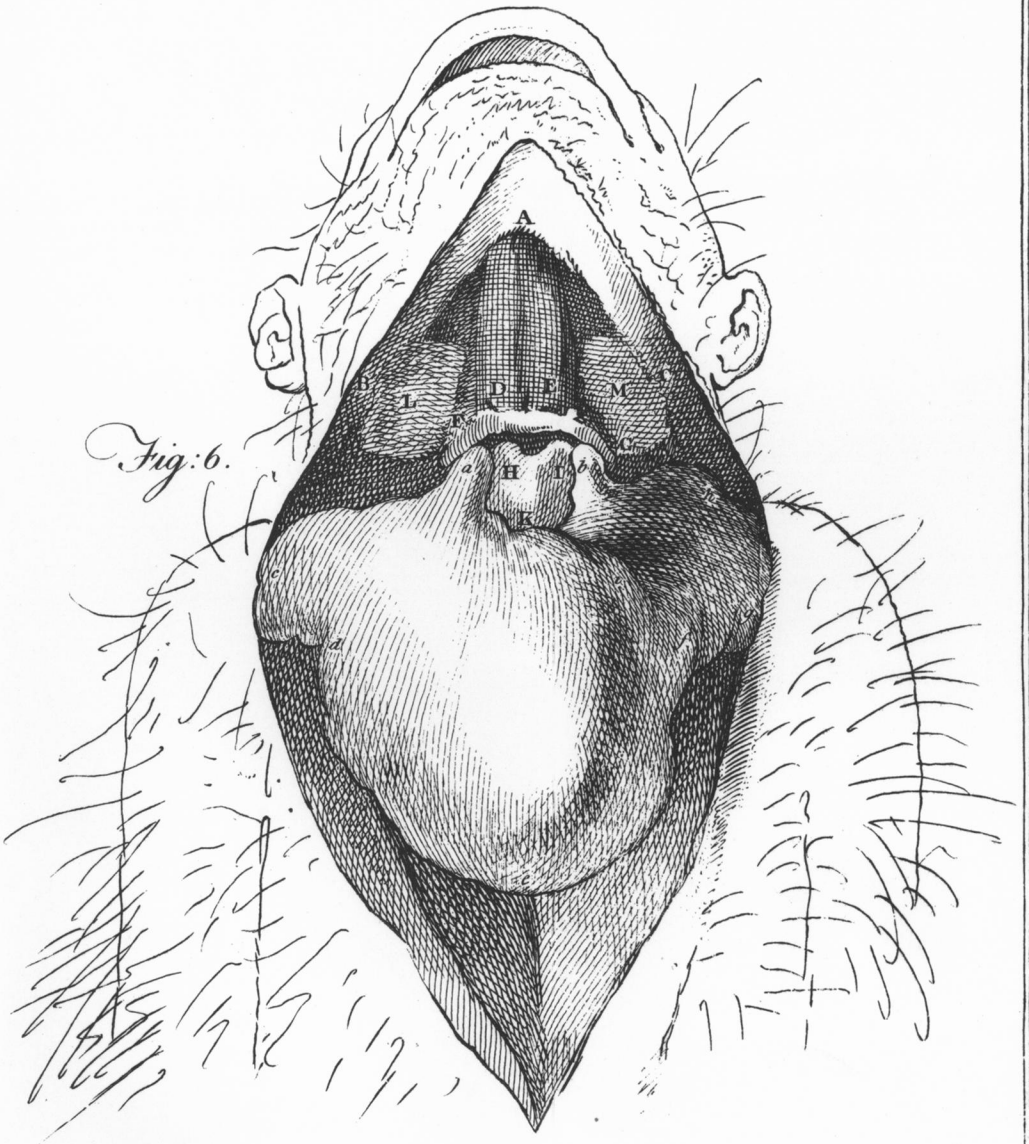


Fig: 6.



a, b, a, i, the holes or orifices by which the air enters into the two ventricles *R, s* and *z, x*, fig. 2.

b, c, b, d, the right *arytenoid* cartilage, with its *capitulum d*.

i, g, f, the left *arytenoid* cartilage.

f, e, d, the *epiglottis*.

g, b, k, l, the *cricoid* cartilage, divided and dilated.

k, m, n, l, the wind-pipe.

Fig. 6. the fore part of the Orang, which I preserve entire in my museum. The skin of the neck and the *latissimi colli* are laid open, to shew the ventricles, &c.

A, B, C, the lower jaw-bone; *A, D, A, E*, the *genio hyoides*.

F, G, the *cornua* of the *os hyoides*.

H, I, the *thyroid* cartilage; *K*, the *cricoid*.

L, M, the sub-maxillary glands.

a, c, d, e, f, g, b, b, the large bladder formed by the union of the two ventricles, of which *i, f*, is a mark.

a and *b*, the two *meatus's* entering towards the inside of the *larynx*, betwixt the *thyroid* cartilage and the *os hyoides*.

